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Grassed Waterways-Construction and Maintenance

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Grassed waterways are natural or constructed drainageways protected by grass sod. Good waterways provide for runoff without damage by erosion, siltation, or flooding. Grassed waterways, needed in the drainageways of many fields, are an essential part of soil conservation on many farms. A step-by-step look at the procedures for designing, constructing, and maintaining a waterway follows.

Determine the general location of the waterway. Use a natural drainageway if possible. Grassed waterways are used as outlets for terrace systems, too; the design of the system determines the location of the waterway. Always consult competent soil conservationists.

Determine the acreage that drains into the waterway. Walk the boundary of the drainage area or watershed and sketch it on a map or aerial photograph of the land. Then measure the area. The size of the waterway depends on the size of the area drained (figure 1).

Figure 1. The shaded area covers one watershed on parts of 120 acres. Part of it is on an adjoining farm.

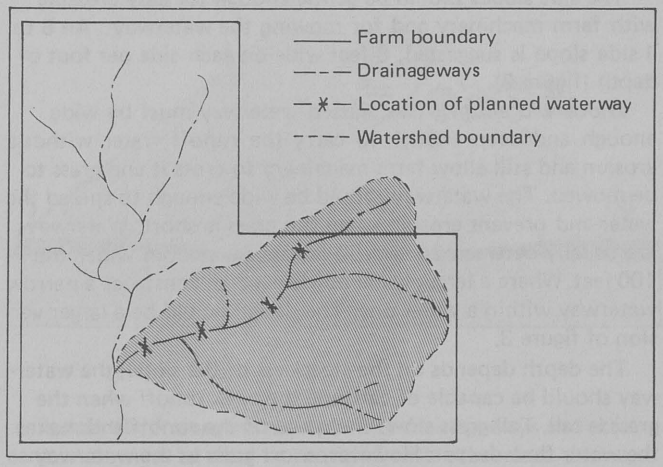


Figure 2. Most waterways are designed like a trapezoid.

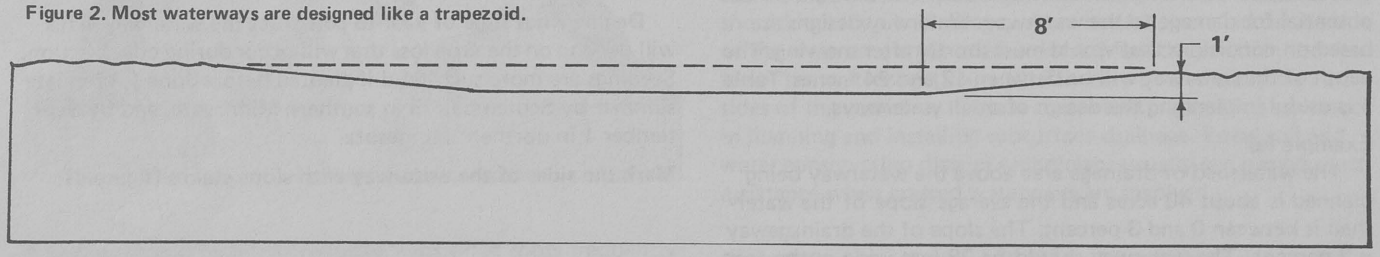
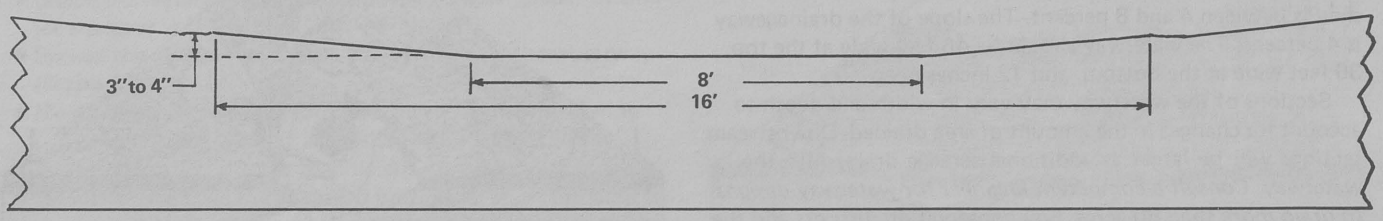


Figure 3. The depressed center of a wide waterway will reduce the tendency of the water to meander when smaller amounts are flowing.



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Plan the width, depth, and shape of the waterway. A good grassed waterway depends on an adequate design capacity, correct shape, thick grass sod cover, and continuing maintainence. The soil and water conservation plan for the entire farm should be developed before a waterway for a specific field or drainage area is located, planned, and constructed.

Design capacity. Waterways are usually designed for the minimum capacity required to carry the greatest amount of runoff from the heaviest 24-hour rain that would be expected to occur once in 10 years. For example, in southeastern Minnesota the waterway size would need to be large enough to carry the runoff that would flow from 4.3 inches of rain falling in 24 hours.

Shape. Most grassed waterways are trapezoid in shape (figure 2). Try to keep the bottom of the waterway very flat during shaping and seeding so runoff will spread evenly over the bottom. Waterways with bottoms wider than 14 feet should be constructed so that the center 8 feet of width is 3 to 4 inches deeper than the rest of the bottom on either side (figure 3). This will reduce water meandering during periods of low flow.

The side slopes should be gentle enough for easy crossing with farm machinery and for mowing the waterway. An 8 to 1 side slope is suggested, 8 feet wide on each side per foot of depth (figure 2).

Width and depth. The grassed waterway must be wide enough and deep enough to carry the runoff water without erosion and still allow farm machinery to cross it and grass to be mowed. The waterway should be wide enough to spread the water and prevent erosion when the grass is short. Waterways are usually between 24 and 50 feet wide, seldom wider than 100 feet. Where a larger waterway is needed, construct a narrow waterway within a wider one. The design would be a larger version of figure 3.

The depth depends on the steepness of the slope; the waterway should be capable of carrying the peak runoff when the grass is tall. Tall grass slows the speed of the runoff and makes the water flow deeper. However, short grass in the waterway stops or traps less sediment, creates a heavier stand of grass, and causes less turbulence in the flowing water. There would be less potential for damage to the waterway. Waterway designs are based on conditions that would exist shortly after mowing. The depth of the waterway will be between 12 and 24 inches. Table 1 is useful in planning the design of small waterways.

Example (a)

The watershed or drainage area above the waterway being planned is about 40 acres and the average slope of the watershed is between 0 and 3 percent. The slope of the drainageway is 2 percent. The waterway should be 28 feet wide at the top, 8 feet wide at the bottom, and 15 inches deep in the center.

Example (b)

The watershed or drainage area above the waterway being planned is about 60 acres and the average slope of the watershed is between 4 and 8 percent. The slope of the drainageway is 4 percent. The waterway should be 46 feet wide at the top, 30 feet wide at the bottom, and 12 inches deep.

Sections of the waterway may vary in width and depth to account for changes in the amount of area drained. Downstream sections will be larger as additional acreage drains into the waterway. *Consult a competent engineer for waterway designs to drain more* than 80 acres. Soil conservation districts and the Soil Conservation Service (SCS) can provide planning assistance.

Table 1. Recommended widths and depths of small waterways

Slope of waterway channel		Watershed Acres Drained						
		10	20	30	40	60	80	
1%	T ft.	28	30	32	34	35	36	flat sloping watersheds, average slope: 0-3%
	D in.	16	17	18	19	20	22	
	B ft.	8	8	8	8	8	8	
2%	T ft.	24	25	25	28	30	30	
	D in.	12	14	14	15	17	17	
	B ft.	8	8	8	8	8	8	
3%	T ft.	28	28	30	32	42	48	moderately sloping watersheds, average slope: 4-8%
	D in.	14	14	13	13	13	13	
	B ft.	8	8	12	14	24	30	
4%	T ft.	26	26	30	35	46	51	
	D in.	13	13	13	13	12	11	
	B ft.	8	8	12	18	30	36	
5%	T ft.	24	26	31	38	48	56	
	D in.	12	12	11	10	10	10	
	B ft.	8	10	16	24	35	44	

T: total width of waterway between the top edges in feet.
B: width of bottom of waterway in feet.
D: depth of waterway in the center in inches.

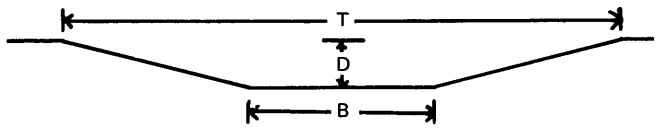


Figure the cost of constructing and seeding the waterway and of providing a suitable outlet. Cost-sharing assistance is available from the soil conservation district or the Agricultural Stabilization and Conservation Service (ASCS). Consult one or both agencies about proper application and approval procedures as far in advance of waterway construction as possible. Designs and specifications, as well as completed construction, must be approved by the SCS before cost-share payments are made. In fact, to be eligible for cost-sharing, approval from the agencies involved must be obtained before starting the intended construction.

Decide what time of year to construct the waterway. This will depend on the crop loss that will occur during construction. Seedings are more successful if planted before June 1, or in late summer by September 15 in southern Minnesota, and by September 1 in northern Minnesota.

Mark the sides of the waterway with slope stakes (figure 4).

Figure 4. Use slope stakes to mark the outer edge of the intended waterway. The waterway should slope toward the center beginning at these stakes.

Clear or bury brush, rocks, and debris. Bury these to one side or elsewhere and not beneath the waterway (figure 5).

Construct the waterway.

- Decide what machinery will be needed; use a scraper, bulldozer, or other earthmoving equipment.
- Sod should be broken apart thoroughly with a disk before moving it to make stockpiling and spreading easier.
- Stockpile surface soil out of the way and spread it again after the waterway has been constructed (figure 6).

Figure 5. Remove brush, trees, debris, and rock. Bury them elsewhere, not beneath the waterway.

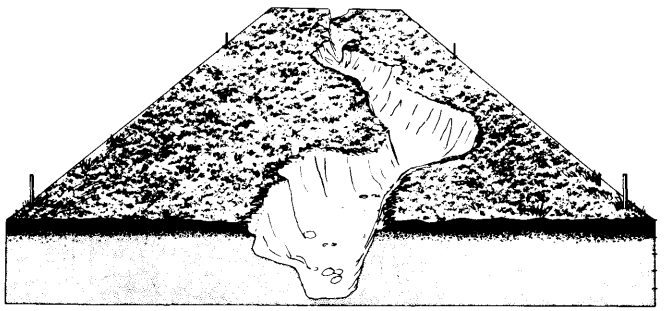
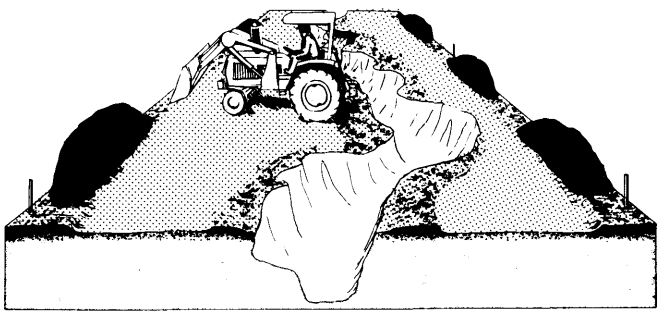


Figure 6. Stockpile surface soil out of the way for respreading after the waterway has been constructed.



- Gullies should be filled gradually. Pack filled spots frequently with heavy rubber-tire equipment as the earth is added. Otherwise these spots may settle and erode (figure 7).
- *Be safety conscious.* Do not get so near the edge that the bank gives way or the equipment tips over.
- Shape the waterway with a bulldozer, scraper, grader or similar equipment (figure 7).
- Spread the stockpiled surface soil evenly over the waterway (figure 8).
- Measure the waterway depth and width frequently during construction and when it is finished to be sure of its design. Soil conservation district technicians may assist with this.
- Be sure all excess earth is spread back away from the sides of the waterway so that runoff can flow into the waterway freely from the adjoining land.

Figure 7. Fill gullies gradually, packing the fill frequently to prevent later settling and subsequent erosion.

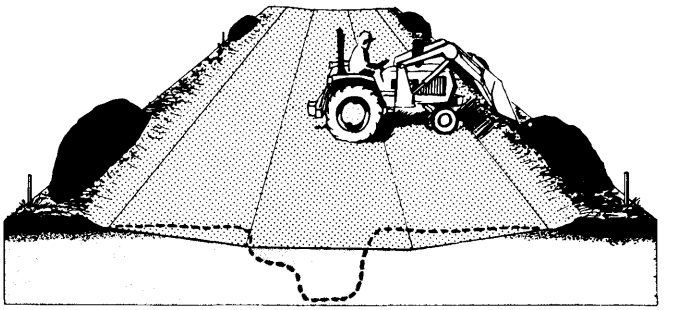
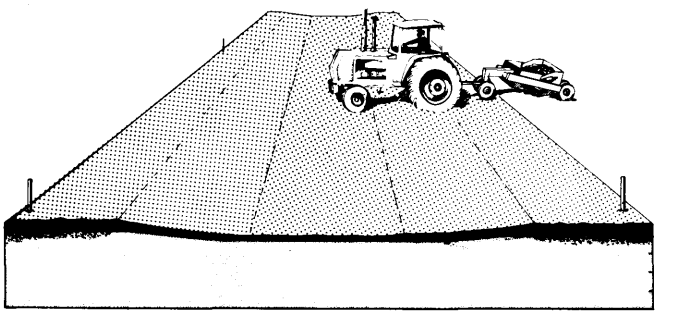
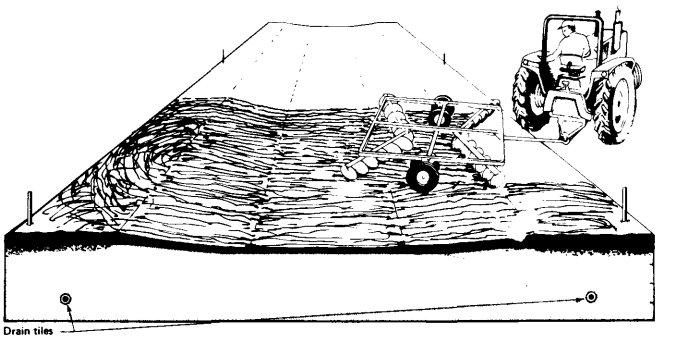


Figure 8. Spread the stockpiled surface soil evenly over the constructed waterway.



Install tile drainage if needed. Wet drainageways and adjacent areas must be tiled or provided with subsurface drainage before satisfactory grassed waterways can be established and the area conveniently farmed. The design of the waterway should include tile drainage, where needed, installed on the side of the waterway and placed at least 2 feet deeper than the center of the waterway (figure 9). Tile may be necessary on both sides of the waterway. Obtain competent engineering assistance in planning and installing subsurface drainage. Local soil and water conservation district technicians usually can provide such assistance when grassed waterways are involved.

Figure 9. Drain tile, if needed, should be installed to the side of the waterway and be placed at least 2 feet deeper than the center of the constructed waterway.



Be sure the lower end of the waterway has a safe outlet. The lower end should not be an erosion hazard. Steep slopes and ditch banks should be protected by erosion-resistant spillways or outlets. Consult competent engineers for advice and designs.

Fertilize the waterway heavily. The fertility of the soil in the finished waterway probably will be quite variable because of the movement and mixing of surface soil and subsoil. It might be very difficult to get representative soil samples for testing. Commercial fertilizer should be broadcast and worked into the soil during the final disking and harrowing to prepare a seedbed. Use a complete fertilizer at a rate that will provide 80 to 100 pounds per acre each of nitrogen (N), phosphate (P_2O_5), and potassium (K_2O)—700 pounds per acre of 12-12-12, for example.

Prepare a good firm seedbed for grass seeding using a disk and harrow (figure 9).

Plant good quality grass seed. Waterways should have thick, tough sod of grasses noted for giving lush ground cover and dense sod. Use seed that has a high germination rate. Do not include legumes in the mixture; these form no dense sod, shade the earth, and limit grass growth. Erosion of the waterway can result. Select kinds of seed and seeding rates from table 2.

Table 2. Seeding mixtures, rates and depths for grassed waterways

Seed mixture	Seeding rate pounds per acre	Planting depth inches
Smooth bromegrass and perennial ryegrass	30 5	1/2 - 3/4
Smooth bromegrass, Kentucky bluegrass and perennial ryegrass	15 10 3	1/2 - 3/4
Smooth bromegrass, Kentucky bluegrass, timothy and perennial ryegrass	10 10 5 3	1/2 - 3/4
Reed canarygrass and timothy	20 5	1/4 - 1/2
Smooth bromegrass and timothy	15 10	1/2 - 3/4

The final planting rate should be about three times the normal seeding rate for pasture plantings in the area.

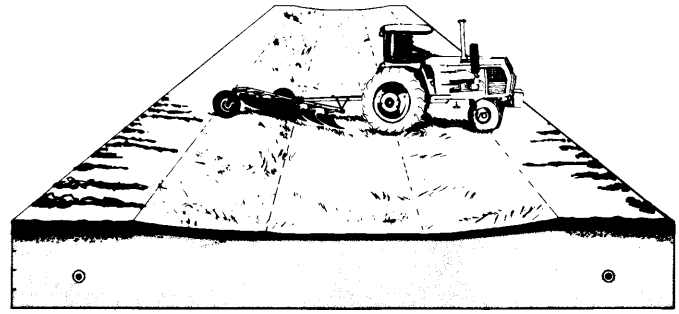
If possible adjust the seeding rate and seed twice to plant at the proper rate. Drill the first seeding lengthwise on the waterway and then plant the second seeding crosswise. If only one seeding is possible, do it crosswise, NOT lengthwise, to avoid wheel tracks and tillage grooves that would encourage erosion.

Mulch the seeded waterway. Spread 1 1/2 to 2 tons per acre of grass hay, straw, or strawy manure. Anchor the straw in the soil using a straingtened disk and working crosswise on the waterway.

Maintain grassed waterways carefully. The value of a good grassed waterway depends on proper maintenance. The objective is to maintain a dense, uniform sod cover.

- Inspect grassed waterways frequently, especially after heavy rains and spring runoff. Repair damage immediately with fill, reshaping, sod staked down, reseeding, and mulch as appropriate.
- Mow the waterway each time hay is cut in the area and remove the mowed grass. This will improve sod density and reduce sediment accumulation on the waterway. Waiting until after July 15 to mow will provide nesting cover for wildlife.
- Control weeds in the waterway with herbicides that do not harm the waterway sod or the crops.
- Control gophers, moles, badgers, and woodchucks to avoid the beginnings of gullies.
- Be sure to *raise tillage machinery and applicators* such as plows, disks, cultivators, anhydrous ammonia applicators, and manure injectors before entering the waterway (figure 10).
- Shut off grass herbicide applicators when crossing waterways.

Figure 10. Raise tillage machinery and applicators before crossing waterways with them.



- **Do not** leave open furrows along the edge parallel to the waterway.
- Avoid using the waterway as a field road. If occasional travel is necessary, drive along the edges of the waterway and not down the center. Do not concentrate travel that will kill the sod or form ruts. Stay out of the waterway when it is wet.
- Do not graze the waterway when it is wet or soft. Keep hogs out at all times.

Sediment accumulation in the waterway reduces its capacity to carry heavy flows of runoff without erosion at the edges of the waterway. If sediment accumulates in the waterway, it means serious erosion is occurring on the area draining into the waterway and other land conservation practices such as conservation tillage, contour farming, terraces, contour strips, or close sown crops are needed. If sediment seriously reduces the capacity of the waterway, rebuilding the waterway is the only solution and the investment in the previous waterway is lost.

Properly constructed and maintained grassed waterways can make farming easier, preserve the land, prevent gullies, and enhance the quality of runoff water flowing into lakes and streams.

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